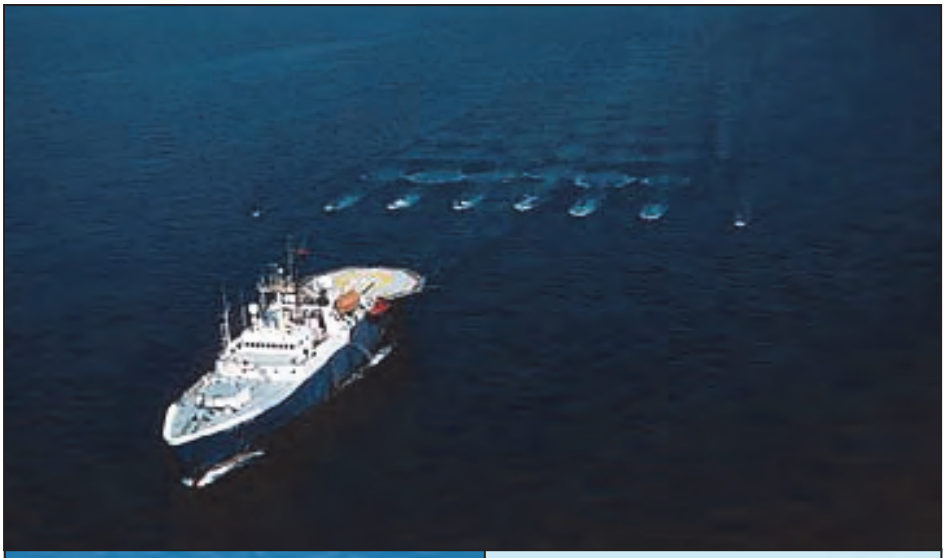
Atlantic OCS
Proposed Geological and Geophysical Activities

Mid-Atlantic and South Atlantic Planning Areas

Final Programmatic Environmental Impact Statement

Volume I: Chapters 1-8, Figures, Tables, and Keyword Index



U.S. Department of the Interior
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region

SUMMARY

Introduction

The Bureau of Ocean Energy Management (BOEM) has prepared this Final Programmatic Environmental Impact Statement (Programmatic EIS) to assess environmental impacts of authorizing geological and geophysical survey activities (G&G activities) in the Mid- and South Atlantic Outer Continental Shelf area (Mid- and South Atlantic OCS) and adjacent State waters between 2012 and 2020. The analysis covers G&G activities conducted under BOEM's oil and gas, renewable energy, and marine minerals programs. The Programmatic EIS also addresses impacts in adjacent State waters because environmental impacts of G&G activities in the Mid- and South Atlantic OCS under BOEM's jurisdiction, such as seismic surveys, could impact the States.

The area covered by the Programmatic EIS ("Area of Interest" or "AOI") extends from the mouth of the Delaware Bay to just south of Cape Canaveral, Florida, and from the shoreline (excluding estuaries) to 648 kilometers (km) (403 miles [mi]) from shore. The total AOI is 854,779 km^2 (330,032 mi^2), and water depths range from 0 to 5,629 meters (m) (0 to 18,468 feet [ft]). The AOI is the area in which the activities of the proposed action would take place and, therefore, the area of potential effect of the Programmatic EIS. BOEM has received nine permit requests for G&G activities in support of oil and gas exploration in the AOI, and industry has expressed interest in expanding G&G activities. Existing survey information on oil and gas resources from the 1970's and 1980's was collected with technology that is now outdated, and new surveys are needed to make informed decisions for energy production and environmental protection. Given the scope of the proposed surveys and their potential impacts, BOEM has determined a Programmatic EIS under the National Environmental Policy Act (NEPA) is needed before permitting any new, large-scale G&G surveys. Furthermore, the Congress has requested preparation of the Programmatic EIS in the Conference Report to the Department of the Interior, Environment, and Related Agencies Appropriation Act, 2010 (Report 111-316).

The Programmatic EIS does not authorize any particular G&G activities. Instead, the Programmatic EIS provides a higher level analysis of impacts from which site-specific NEPA evaluations will draw, or be "tiered" as described in the NEPA regulations of the Council on Environmental Quality (CEQ). Site-specific environmental evaluations will address details of proposed G&G activities, potential impacts, mitigation, and monitoring, and they will support site-specific intergovernmental consultations and decisions on authorizations and conditions to be applied under applicable laws.

The Alternative Actions

The Programmatic EIS evaluates three potential alternative actions by BOEM: to authorize G&G activities with time-area closures and standard mitigation as described below (**Alternative A, the Proposed Action**); to authorize G&G activities with additional time-area closures, geographic separation of simultaneous seismic airgun surveys, and use of passive acoustic monitoring (**Alternative B, the Preferred Alternative**); and no action - the status quo (**Alternative C**). Alternatives A and B are identical with respect to the G&G activities that could be conducted and the expected activity levels during the 2012-2020 period. They differ only in that Alternative B would expand the time-area closure for North Atlantic right whales (NARW) provided in Alternative A; add a time-area closure offshore Brevard County, Florida, to protect nesting sea turtles; consider a 40-km (25-mi) separation between concurrent seismic airgun surveys; require passive acoustic monitoring (PAM) in seismic airgun surveys; and also require use of PAM or similar equipment in some HRG surveys. Alternative B has been identified as the Preferred Alternative. Alternative C is the No Action Alternative required by CEQ regulations implementing NEPA. Under this alternative, no G&G activities associated with oil and gas exploration would occur in the AOI, but G&G activities for renewable energy development and marine minerals use would continue on a site-specific basis. Several additional alternatives were identified during the scoping process, but they were eliminated from detailed analysis for the reasons identified in **Chapter 2.5**. Examples include limiting G&G activities to renewable energy and marine minerals; reprocessing existing G&G data for oil and gas; delaying the permitting process; consolidating and

Levels of Impact

The Programmatic EIS evaluates and assigns levels of environmental impact caused by IPFs as follows, with categories tailored as needed to fit characteristics of differing IPFs:

- **Negligible**: Little or no measurable/detectable impact.
- **Minor**: Impacts are detectable, short-term, extensive or localized, but less than severe.
- **Moderate**: Impacts are detectable, short-term, extensive, and severe; or impacts are detectable, short-term or long-lasting, localized, and severe; or impacts are detectable, long-lasting, extensive or localized, but less than severe.
- **Major**: Impacts are detectable, long-lasting, extensive, and severe.

Environmental Impacts of Alternative A

Impacts on Marine Mammals

Thirty-nine species of marine mammals occur or may occur within the AOI, including 34 cetacean species, 1 sirenian (the Florida subspecies of the West Indian manatee), and 4 pinnipeds (gray seal, harbor seal, hooded seal, and harp seal). The manatee and the four seal species probably do not occur in the AOI currently; therefore, only 34 marine mammal species are potentially impacted. Six of the potentially impacted marine mammal species are endangered species, including five baleen whales (NARW, blue whale, fin whale, sei whale, and humpback whale) and one toothed whale (sperm whale). The IPFs affecting marine mammals are active acoustic sound sources, vessel and equipment noise, vessel traffic, aircraft traffic and noise, trash and debris, and accidental fuel spills.

Impacts of Active Acoustic Sound Sources

Alternative A includes extensive seismic airgun surveys, as well as HRG surveys. Airguns produce acoustic pulses that are within the hearing range of all marine mammals. Most HRG surveys use only electromechanical sources, such as side-scan sonars; boomer, sparker, and chirp subbottom profilers; and multibeam depth sounders, some of which have frequencies beyond the functional hearing range of marine mammals. However, some HRG surveys may use small airguns. Based on the scope of the proposed action, seismic airgun surveys and non-airgun HRG surveys could affect individuals from all 34 potentially impacted marine mammal species reported from the AOI.

Incidental take levels of marine mammals through acoustical disturbance was estimated for Alternative A using the Acoustic Integration Model©. The model used both the current NMFS-established criteria and the Southall et al. (2007) criteria to estimate take. The difference between the two sets of criteria for harassment is that NMFS currently uses "precautionary" thresholds that would indicate when the *potential* for Level A or Level B harassment cannot be dismissed. In other words, the sound level may or may not actually cause harassment, but it might. The Southall et al. (2007) criteria estimate threshold levels where harassment may actually occur, and hence these take estimates are lower. **Chapter 4** and **Appendices D** and **E** provide detailed explanations of the models and results.

The "Modeled Marine Mammal Take Estimates" section above summarizes the conservative nature of these modeled estimates. Again, the models do not take into account all of the extensive mitigation measures summarized in **Table S-1** or other caveats discussed below, and actual take through acoustic disturbance is expected to be less than modeled estimates. For example, the Level A incidental takes predicted do not take into account the mitigation measures included in the Seismic Airgun Survey Protocol that establishes a 180-decibel (dB) acoustic exclusion zone around airgun arrays. The acoustic exclusion zone must be clear of any marine mammals and sea turtles for at least 60 minutes before an airgun survey can start. The airgun array is then slowly ramped-up, rather than turned on immediately at full power, so that animals have an opportunity to move away before airgun levels reach potentially disturbing levels. Further, Protected Species Observers (PSOs) continuously monitor the 180-dB exclusion zone for marine mammals and call for the immediate shut down of the airgun array if marine mammals are detected within or approaching this exclusion zone. However, it should be noted that the

effects of mitigation measures, and other caveats described below, cannot be quantified with precision, and mitigation measures may not be fully implemented. For example, visual and PAM are not 100 percent effective due to factors such as physical conditions (e.g., inclement weather), presence of animals at the surface, difficulty in species identification, lack of vocalizing animals, and limitations in equipment used for monitoring. Further, larger acoustic exclusion zones are more difficult to monitor than smaller zones.

For seismic airgun surveys, the total annual Level A and Level B incidental takes were estimated for 2012-2020 using the NMFS and Southall et al. criteria. The modeling predicts Level A harassment of all marine mammal species in the AOI, except the West Indian manatee and the three modeled seal species (gray, harbor, and hooded seals). Using NMFS's 180-dB criterion, the five species with the highest numbers of annual Level A takes are estimated to be as follows:

- bottlenose dolphin (up to 11,748 individuals/year);
- short-beaked common dolphin (up to 6,147 individuals/year);
- Atlantic spotted dolphin (up to 5,848 individuals/year);
- short-finned pilot whale (up to 4,631 individuals/year); and
- striped dolphin (up to 3,993 individuals/year).

Using the Southall et al. (2007) criteria, estimated Level A takes are much lower than predicted by NMFS, with the following top five species:

- Atlantic spotted dolphin (up to 1,496 individuals/year);
- striped dolphin (up to 1,020 individuals/year);
- Risso's dolphin (up to 731 individuals/year);
- pantropical spotted dolphin (up to 263 individuals/year); and
- short-beaked common dolphin (up to 225 individuals/year).

The modeling also predicts Level B harassment of all marine mammal species except the West Indian manatee and the three modeled seals species (gray, harbor, and hooded seals). Using NMFS's 160-dB criterion, the five species with the highest annual Level B take estimates are as follows:

- bottlenose dolphin (up to 1,151,442 individuals/year);
- short-beaked common dolphin (up to 602,424 individuals/year);
- Atlantic spotted dolphin (up to 573,121 individuals/year)
- short-finned pilot whale (up to 453,897 individuals/year); and
- striped dolphin (up to 391,376 individuals/year).

Six potentially impacted marine mammal species in the AOI are endangered species: NARW; blue whale; fin whale; sei whale; humpback whale; and sperm whale. The modeling predicts Level A and Level B incidental takes of all these species. The estimated take is highest for the humpback whale, with estimated Level A takes of up to 12 individuals/year using NMFS's 180-dB criterion (up to 6 individuals/year following Southall et al. [2007]) and Level B takes up to 1,131 individuals/year using NMFS's 160-dB criterion. The modeling predicts Level A incidental takes of 0-2 NARW individuals/year using NMFS's 180-dB criterion and less than one individual using the Southall et al. (2007) criterion. Level B incidental takes of the NARW are estimated by the models to range from 0 to 224 individuals/year. The proposed action includes a time-area closure for NARWs that has been factored into the incidental take calculations. The closure reduces estimated Level A and Level B incidental takes of NARWs by about 67 percent (as compared with no time-area closures). Other mitigation measures not considered in the take models are also expected to reduce actual take.

These modeled take estimates should be regarded as conservative and higher than the probable actual take. The acoustic and impact modeling conducted to support the Programmatic EIS is by its very nature complex and requires numerous assumptions to predict results in scenarios where

- the period modeled is in the future and spans 5 years, during which the knowledge of the source locations and movement, animal locations and movement, oceanographic/acoustic conditions, equipment descriptions and specification, and even the time of the year for each survey are not precisely known;
- the details of marine mammal abundances, distributions, and behavior patterns are not precisely known and are subject to change as animal populations vary from year to year and location to location; and
- the development of new or re-designed survey equipment, survey techniques, survey geometries, or even signal processing approaches could change.

Despite uncertainty and variability in future actions, the use of models require numerous specific details to be identified and used during their calculations. Each of the inputs into the models is therefore purposely developed to be conservative (overly predictive), and this conservativeness accumulates throughout the analysis. For example, representative sound sources are modeled at highest sound levels and always at maximum power and operation; sound levels received by an animal are calculated at highest levels; marine mammal density values used likely exceed actual densities; and models do not include the effect of all mitigations in reducing take estimates. Additional assumptions that add to the conservativeness of the models are noted below. **Chapter 1** and **Appendices D** and **E** provide greater detail on the development and results of these models.

- **Acoustic Source Specifications:** There is a large variation in the size, configuration, and source level of the airgun arrays potentially employed during surveys. The modeling selected one source as representative of those used that was more powerful than about 95 percent of the sources listed in the various survey types. Additionally, it was assumed that the modeled array was always at maximum power and that all airguns were fully operational for fully completed survey scenarios. Similarly, for the mineral resources survey, the most conservative parameters were assumed for source level, signal repetition rate, pulse length, and other factors. These assumptions will not always be met in the field.
- **Acoustic Source Modeling:** For simplicity, the acoustic modeling replaces the actual predicted distributed airgun array sound field with a sound field produced by a single hypothetical single large airgun and a beam pattern. This is fairly accurate in the far-field, which is typically 100-300 m (328-984 ft) from the array center and outward, but in the closer near-field this can greatly overestimate the apparent source level and the subsequent impacts calculated. This conservative near-field approximation could be corrected in the model; however, the approximation is highly dependent on the actual source parameters. It would be difficult to justify making such a correction in the Programmatic EIS, which would greatly enlarge the modeling effort while not necessarily improving accuracy of the estimates.
- **Acoustic Propagation Modeling:** Typically, the acoustic parameters used in acoustic modeling (including sound velocity profile, bottom sediment types/distributions/thicknesses/coefficients, and surface wind and wave values) are averaged seasonal values over reasonably sampled areas and time periods. These averaging processes remove most local variability while capturing the general effect of the sound speed on acoustic propagation. This generally tends to underestimate the transmission loss and therefore overestimate the received levels at all ranges to some degree. Actual *in situ* propagation, therefore, typically displays much more fading and disruption of the signal, especially for signals shorter than 1 second (i.e., airguns).
- **Acoustic Modeling of the Multi-Path:** When a signal propagates through the ocean, it typically follows many pathways between the source and a receiver (e.g., an animal). For example, one path may be directly between the source and receiver, while others may reflect off of the ocean surface or bottom before arriving at the receiver. For most of the models used in acoustic propagation analyses, the model assumes that the signals continue until all of the significant paths have arrived at the

receiver. The energy from these different pathways is then summed to derive a final received value. This is a conservative approach for short signals, like airgun pulses, and this spreading of a signal (and its energy) generally increases as range increases. This is not a simple or easy correction to make since it can also be highly dependent on the receiver's position in range and depth. Therefore, the conservative assumption is used. Additionally, real world localized effects, such as bubble plumes from breaking waves and the scattering of sound from plants and air present near the ocean's surface, also greatly reduce received levels for animals within 3-6 m (10-20 ft) of the ocean's surface.

- **Marine Mammal Density Values:** Marine mammal density values used in acoustic modeling are typically very conservative. As a simple check of their conservatism, a calculation consisting of multiplying each density value by the area that it covers and then summing these values results in total population values that greatly exceed those identified in the Marine Mammal Stock Assessment reports.
- **Marine Mammal Congregations:** Marine mammals, especially dolphins, often occur in pods or groups of animals. When this occurs, the actual density near that pod can be greater than those used in these calculations, but the corresponding density for much of the surrounding areas has been decreased. Statistically, this averages out for multiple model runs that do not account for this. However, when this occurs during actual operations, sources may be turned off, especially since large pods of dolphins, which often can consist of hundreds of animals, are much easier to observe and mitigate for.

Overall impacts from airgun surveys on marine mammals are expected to be **moderate**.

Impacts of Non-Airgun HRG Surveys

Non-Airgun HRG surveys would use only electromechanical sources such as side-scan sonars; boomer, sparker, and chirp subbottom profilers; and multibeam depth sounders. Boomer and sparker pulses are expected to be within the hearing range of all marine mammals. However, the operating frequency of the representative multibeam system selected for the Programmatic EIS is above the hearing range of all cetaceans. For the representative side-scan sonar and chirp subbottom profiler systems, some frequencies are within the hearing range of cetaceans, but others are not. Frequencies emitted by individual equipment may differ from these representative systems selected for analysis.

Based on the scope of the HRG survey scenarios, any of the 34 potentially impacted marine mammal species within the AOI could be affected. In addition, marine mammals inhabiting primarily shelf-edge or deepwater habitats (e.g., sperm whales, spinner dolphins, etc.) are unlikely to be exposed to noise from most HRG surveys because these surveys would typically be in relatively nearshore waters. High-resolution geophysical surveys for renewable energy projects are expected to occur in waters less than 40 m (131 ft) deep and marine minerals surveys are expected to occur in waters less than 30 m (98 ft) deep. However, HRG surveys for oil and gas are expected to occur in all water depths.

For non-airgun HRG surveys, modeling of incidental take predicts low numbers (a few individuals per survey year) of Level A harassment for all marine mammal species (except manatees and the three seal species modeled) in the AOI. The modeling also predicts Level B harassment (except manatees and the three seal species modeled), with numbers ranging up to several hundred individuals per year (e.g., 92-632 individuals/year for bottlenose dolphin, the species with the highest numbers). All six of the potentially impacted endangered marine mammal species are predicted to have essentially zero Level A incidental takes using both NMFS's 180-dB criterion and the Southall et al. (2007) criteria. The highest estimated Level B incidental takes for these endangered species are estimated for the sperm whale (0-12 individuals/year). All of the endangered mysticete whales have estimated Level B incidental takes of less than one individual/year, with the highest estimate being for NARW (0.19-0.87 individuals/year). These modeled estimates for HRG surveys overstate take levels for the same reasons that they overstate airgun takes.

In conclusion, it is expected that there would be little or no Level A harassment resulting from non-airgun HRG surveys. Depending on the operating frequencies and source levels of the

electromechanical sources used for a particular survey, the underwater noise may be above the hearing range of marine mammals or cause impacts only at very close range. The most likely and extensive effects of HRG surveys on marine mammals would be behavioral responses (Level B harassment). Because most or all Level A harassment would likely be avoided and because of the low numbers of Level B harassments predicted, overall impacts on marine mammals from non-airgun HRG surveys are expected to be **minor**.

Other Impacts on Marine Mammals

Vessel noise has been observed to elicit a variety of behavioral responses in marine mammals and may contribute to auditory masking. These behavioral responses may include evasive maneuvers such as diving or changes in swimming direction or speed. Alternative A includes a time-area closure for G&G surveys deploying airguns in NARW critical habitat in the periods when vessel speed restrictions are in force under the Right Whale Ship Strike Reduction Rule (from November 15 through April 15) and in the Mid-Atlantic and Southeast U.S. Seasonal Management Areas (SMAs) from November 1 through April 30. Authorizations for other (non-airgun) HRG surveys in these areas may include additional mitigation and monitoring requirements to avoid or reduce impacts on NARWs. These measures would be expected to reduce vessel-related noise impacts to NARWs during their seasonal migration and calving and nursing periods. The time-area closure would also reduce impacts on other marine mammals during those time periods. Based on the expected relatively low volume of vessel traffic associated with project activities within the AOI and the presumption that individuals or groups of marine mammals within the AOI will be familiar with various common vessel-related noises, particularly within frequented shipping lanes, the impacts of vessel noise on marine mammals within the AOI are expected to be **negligible** to **minor**.

Other sound sources associated with Alternative A include drilling-related equipment noise during the completion of up to three deep stratigraphic test wells and up to five shallow test wells during the time period covered by the Programmatic EIS. These sounds may elicit behavioral responses such as changes in swimming direction or speed. However, considering the small number of drilling operations, the continuous nature of sounds produced during these activities, and the mitigation measures in place for Alternative A, it is expected that the noise impacts on marine mammals would be **minor**.

Marine mammals are vulnerable to vessel strikes. However, all authorizations for shipboard surveys would include guidance for vessel strike avoidance. It is unlikely that survey vessels would strike marine mammals because they would travel slowly during surveys (typically between 4.5-6 knots [kn]). In addition, during surveys, waters surrounding survey vessels would be visually monitored by PSOs for marine mammals and turtles. Vessel movements would be subject to BOEM guidance for vessel strike avoidance, and vessel operators would be required to reduce speed in certain areas to comply with the Right Whale Ship Strike Reduction Rule. Vessel traffic impacts are expected to be **negligible**.

Alternative A includes one or two aeromagnetic surveys and the possibility of helicopter traffic in support of drilling of deep stratigraphic and shallow test wells. Low-flying aircraft can disturb marine mammals with noise and visual appearance. However, the exposure of individual marine mammals to aircraft-related noise would be expected to be brief in duration. Considering the relatively low level of aircraft activity included in the proposed action, along with the short duration of potential exposure to noise and visual disturbance, potential impacts from this activity are expected to be **negligible** to **minor**.

Impacts to marine mammals from discarded trash and debris are expected to be avoided through vessel operators' required compliance with U.S. Coast Guard (USCG) and U.S. Environmental Protection Agency (USEPA) regulations. In addition, all authorizations for shipboard surveys would include the Bureau of Safety and Environmental Enforcement (BSEE) guidance for marine debris awareness. Therefore, impacts are expected to be **negligible**.

An accidental fuel spill could affect marine mammals through various pathways: direct contact; inhalation of volatile components; ingestion (directly or indirectly through the consumption of fouled prey species); and, for mysticetes, impairment of feeding by fouling of baleen. Cetacean skin is highly impermeable and is not significantly irritated by brief exposure to diesel fuel; hence, limited direct contact is not likely to produce a significant impact. A small fuel spill would not be likely to result in the death or life-threatening injury of individual marine mammals or the long-term displacement of these animals from preferred feeding or breeding habitats or migratory routes. It is expected that spilled fuel oil or

diesel fuel would rapidly disperse on the sea surface to a very light sheen and would weather rapidly. The impacts would be **negligible** to **minor**.

Impacts on Sea Turtles

Five sea turtle species occur in the AOI: loggerhead, green, hawksbill, Kemp's ridley, and leatherback turtles. The hawksbill, Kemp's ridley, and leatherback turtles are listed under the ESA as endangered. The green turtle is listed as threatened, except for the Florida breeding population, which is endangered. The Northwest Atlantic population of the loggerhead turtle is classified as threatened. Loggerhead, leatherback, and green turtles are more commonly found within the AOI during nesting season and in certain life stages. Kemp's ridley and particularly hawksbill turtles are less common within the AOI. Green, leatherback, and loggerhead turtles nest on coastal beaches within the AOI, with most nests in southeast Florida. However, loggerhead turtles also nest along the southeast coast as far north as Virginia. The relevant IPFs for sea turtles are active acoustic sound sources, vessel and equipment noise, vessel traffic, aircraft traffic and noise, trash and debris, and accidental fuel spills.

Impacts of Active Acoustic Sound Sources

Alternative A includes extensive seismic airgun surveys, as well as HRG surveys, and the low-frequency pulses of airguns that are believed to be within the hearing range of sea turtles. High-resolution geophysical surveys typically use only electromechanical sources such as side-scan sonars; boomer, sparker, and chirp subbottom profilers; and multibeam depth sounders. The survey protocol for HRG sound sources operating at or below 200 kilohertz (kHz) (HRG Survey Protocol) includes establishing a 200-m (656-ft) radius acoustic exclusion zone around the sound source, and visual monitoring by trained PSOs. The HRG Survey Protocol also restricts HRG surveys within the NARW critical habitat from November 15 to April 15 for surveys using equipment that operates at frequencies at and below 30 kHz. Based on the source levels of most boomer and sparker equipment and implementation of the HRG Survey Protocol, impacts on sea turtles from HRG surveys using boomer or sparker subbottom profilers are expected to range from **negligible** to **minor**, based on the distance of the individual sea turtle from the sound pulse.

Seismic airgun surveys could affect all sea turtle species within the AOI, potentially including hawksbill turtles within the southernmost part of the AOI. Subadult and adult turtles may be more likely to be affected by seismic airgun noise than post-hatchling turtles due to the time that the former remain submerged and at depth. Post-hatchling turtles generally reside at or near the sea surface and may be less likely to be harmed by the sound field produced by an airgun array. Seismic airgun surveys in nearshore waters would affect a greater number of individual turtles, particularly species other than leatherbacks. Deepwater surveys are likely to affect fewer individual turtles but are more likely to affect leatherback turtles, particularly within areas of upwelling where individuals may be found in feeding aggregations. Surveys conducted during summer sea turtle nesting periods may affect greater numbers of adult turtles, particularly loggerhead, green, and leatherback turtles, than surveys conducted during non-nesting periods.

Mitigation measures included in the Seismic Airgun Survey Protocol include ramp-up of airgun arrays, visual monitoring of an acoustic exclusion zone by PSOs, and startup and shutdown requirements. These measures are expected to minimize the potential for injury to sea turtles by ensuring that they are not present within an acoustic exclusion zone around the airgun array. The most likely impacts would be short-term behavioral responses; no deaths or life-threatening injuries would be expected. In general, impacts of seismic airgun surveys on sea turtles are expected to range from **negligible** to **minor**.

However, seismic airgun surveys offshore heavily used nesting beaches during the nesting season could temporarily displace breeding and nesting adult turtles and potentially disrupt time-critical activities. Beaches of southeast Florida have been identified as the most important nesting area for loggerhead turtles in the Western Hemisphere. The northern segment of the Archie Carr National Wildlife Refuge (NWR) borders the AOI, and it has been estimated that 25 percent of all loggerhead nesting in the U.S. occurs there. During the 2010 nesting season, there were over 31,000 loggerhead nests in Brevard County, Florida, which is where the Archie Carr NWR is located. It is likely that large numbers of sea turtles would be present in nearshore waters of Brevard County during the nesting season from May 1 to October 31. Many adult females linger near the nesting beaches before and between

TABLES

Table 4-10

Annual Level A Takes Estimates from Seismic Airgun Sources Using 180-dB Criteria for Marine Mammal Species during the Project Period (2012-2020)

Marine Mammal	Year								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
ORDER CETACEA									
Suborder Mysticeti (Baleen Whales)									
Common Minke Whale	0.000	0.000	0.342	0.666	0.101	0.364	0.285	0.196	0.144
Sei Whale	0.000	0.000	1.965	3.855	0.648	2.473	2.009	1.567	0.925
Bryde's Whale	0.000	0.000	1.948	3.820	0.642	2.445	1.986	1.548	0.918
Blue Whale	0.000	0.000	2.182	4.274	0.700	2.653	2.139	1.632	1.000
Fin Whale	0.000	0.000	4.400	8.638	1.507	5.679	4.657	3.705	2.180
North Atlantic Right Whale	0.000	0.000	1.162	2.290	0.611	1.757	1.595	1.464	0.858
Humpback Whale	0.000	0.000	5.897	11.542	1.853	7.071	5.671	4.275	2.632
Suborder Odontoceti (Toothed Whales, Dolphins, and Porpoises)									
Short-beaked Common Dolphin	0.000	0.000	3121.383	6146.553	1114.258	4282.933	3551.165	2919.887	1611.226
Pygmy Killer Whale	0.000	0.000	2.253	4.410	0.705	2.708	2.170	1.635	0.997
Short-Finned Pilot Whale	0.000	0.000	2354.300	4631.133	840.256	3170.157	2627.151	2145.343	1224.552
Long-Finned Pilot Whale	0.000	0.000	297.400	582.360	96.845	362.017	292.887	224.439	139.821
Risso's Dolphin	0.000	0.000	1619.672	3180.466	551.169	2095.819	1717.190	1367.649	796.896
Northern Bottlenose Whale	0.000	0.000	0.127	0.250	0.043	0.174	0.143	0.116	0.061
Pygmy Sperm Whale	0.000	0.000	2.371	4.592	0.559	2.140	1.562	0.872	0.770
Dwarf Sperm Whale	0.000	0.000	14.844	29.005	4.264	16.952	13.300	9.592	5.939
Atlantic White-sided Dolphin	0.000	0.000	4.668	9.152	1.467	5.795	4.657	3.573	2.063
Fraser's Dolphin	0.000	0.000	0.242	0.468	0.055	0.210	0.151	0.079	0.076
Sowerby's Beaked Whale	0.000	0.000	0.203	0.397	0.060	0.233	0.184	0.134	0.085
Blainville's Beaked Whale	0.000	0.000	39.568	77.313	11.835	45.464	35.978	26.232	16.739
Gervais' Beaked Whale	0.000	0.000	39.568	77.313	11.835	45.464	35.978	26.232	16.739
True's Beaked Whale	0.000	0.000	39.568	77.313	11.835	45.464	35.978	26.232	16.739
Killer Whale	0.000	0.000	1.965	3.843	0.602	2.309	1.839	1.363	0.852
Melon-Headed Whale	0.000	0.000	2.523	4.942	0.818	3.098	2.505	1.924	1.168
Harbor Porpoise	0.000	0.000	7.054	13.798	2.245	8.376	6.733	5.072	3.235
Sperm Whale	0.000	0.000	158.828	309.723	44.502	173.124	134.518	93.561	62.258
False Killer Whale	0.000	0.000	2.801	5.491	0.930	3.501	2.848	2.218	1.334
Pantropical Spotted Dolphin	0.000	0.000	446.741	876.082	145.967	559.932	454.020	352.985	208.113
Clymene Dolphin	0.000	0.000	207.184	406.191	67.382	258.155	209.054	161.919	96.038
Striped Dolphin	0.000	0.000	2038.848	3993.224	650.891	2483.607	2000.683	1526.327	928.896
Atlantic Spotted Dolphin	0.000	0.000	2978.964	5847.582	988.880	3813.267	3105.692	2446.233	1406.107
Spinner Dolphin	0.000	0.000	1.949	3.821	0.634	2.429	1.967	1.523	0.903
Rough-Toothed Dolphin	0.000	0.000	13.755	26.888	4.279	16.048	12.821	9.510	6.112
Bottlenose Dolphin	0.000	0.000	5977.039	11748.210	2090.846	7908.443	6521.887	5266.486	3022.262
Cuvier's Beaked Whale	0.000	0.000	276.973	541.189	82.842	318.247	251.849	183.622	117.174
ORDER SIRENIA									
West Indian Manatee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ORDER CARNIVORA									
Suborder Pinnipedia									
Hooded Seal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gray Seal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor Seal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4-11

Annual Level B Take Estimates (160-dB criteria) from Airgun Surveys for Marine Mammal Species during the Project Period (2012-2020)

Marine Mammal	Year								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
ORDER CETACEA									
Suborder Mysticeti (Baleen Whales)									
Common Minke Whale	0.000	0.000	33.522	65.282	9.857	35.718	27.956	19.257	14.116
Sei Whale	0.000	0.000	192.625	377.801	63.466	242.395	196.917	153.588	90.689
Bryde's Whale	0.000	0.000	190.896	374.359	62.904	239.608	194.649	151.692	89.980
Blue Whale	0.000	0.000	213.901	418.875	68.622	259.980	209.629	159.949	98.045
Fin Whale	0.000	0.000	431.204	846.583	147.732	556.574	456.478	363.111	213.637
North Atlantic Right Whale	0.000	0.000	113.846	224.490	59.848	172.225	156.298	143.499	84.052
Humpback Whale	0.000	0.000	577.964	1131.230	181.646	692.987	555.789	419.002	257.919
Suborder Odontoceti (Toothed Whales, Dolphins, and Porpoises)									
Short-beaked Common Dolphin	0.000	0.000	305926.755	602423.698	109208.426	419770.312	348049.714	286178.116	157916.298
Pygmy Killer Whale	0.000	0.000	220.776	432.193	69.105	265.443	212.700	160.267	97.713
Short-Finned Pilot Whale	0.000	0.000	230744.930	453897.344	82353.473	310707.070	257487.079	210265.101	120018.336
Long-Finned Pilot Whale	0.000	0.000	29148.152	57077.138	9491.739	35481.323	28705.807	21997.239	13703.882
Risso's Dolphin	0.000	0.000	158744.009	311717.478	54020.063	205411.212	168301.811	134043.314	78103.785
Northern Bottlenose Whale	0.000	0.000	12.462	24.544	4.259	17.031	13.994	11.395	6.003
Pygmy Sperm Whale	0.000	0.000	232.353	450.073	54.784	209.782	153.072	85.460	75.450
Dwarf Sperm Whale	0.000	0.000	1454.885	2842.740	417.949	1661.508	1303.577	940.144	582.097
Atlantic White-sided Dolphin	0.000	0.000	457.481	896.987	143.826	567.919	456.474	350.144	202.187
Fraser's Dolphin	0.000	0.000	23.717	45.882	5.427	20.593	14.819	7.782	7.470
Sowerby's Beaked Whale	0.000	0.000	19.910	38.905	5.903	22.874	18.068	13.148	8.286
Blainville's Beaked Whale	0.000	0.000	3878.016	7577.415	1159.902	4455.915	3526.252	2570.966	1640.602
Gervais' Beaked Whale	0.000	0.000	3878.016	7577.415	1159.902	4455.915	3526.252	2570.966	1640.602
True's Beaked Whale	0.000	0.000	3878.016	7577.415	1159.902	4455.915	3526.252	2570.966	1640.602
Killer Whale	0.000	0.000	192.589	376.649	59.002	226.289	180.233	133.567	83.546
Melon-Headed Whale	0.000	0.000	247.240	484.381	80.135	303.674	245.516	188.604	114.448
Harbor Porpoise	0.000	0.000	691.367	1352.385	219.996	820.894	659.933	497.063	317.088
Sperm Whale	0.000	0.000	15566.706	30355.996	4361.663	16967.893	13184.100	9169.873	6101.896
False Killer Whale	0.000	0.000	274.527	538.213	91.113	343.104	279.084	217.358	130.741
Pantropical Spotted Dolphin	0.000	0.000	43785.058	85864.840	14306.228	54878.902	44498.535	34596.047	20397.152
Clymene Dolphin	0.000	0.000	20306.091	39810.739	6604.129	25301.751	20489.358	15869.727	9412.707
Striped Dolphin	0.000	0.000	199827.536	391375.882	63793.815	243418.330	196086.989	149595.327	91041.146
Atlantic Spotted Dolphin	0.000	0.000	291968.246	573121.475	96920.094	373738.318	304388.840	239755.284	137812.574
Spinner Dolphin	0.000	0.000	191.026	374.513	62.127	238.022	192.750	149.292	88.549
Rough-Toothed Dolphin	0.000	0.000	1348.103	2635.268	419.376	1572.892	1256.603	932.059	599.076
Bottlenose Dolphin	0.000	0.000	585809.587	1151442.029	204923.786	775106.463	639210.107	516168.326	296211.886
Cuvier's Beaked Whale	0.000	0.000	27146.110	53041.902	8119.316	31191.403	24683.766	17996.764	11484.217
ORDER SIRENIA									
West Indian Manatee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ORDER CARNIVORA									
Suborder Pinnipedia									
Hooded Seal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gray Seal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Harbor Seal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4-15

Comparison of Take Estimates from Acoustic Sources, without Mitigation

Activity Source and Harassment Level	Incidental Take Estimates - Annual
Navy Training (concentrated in the VACAPES, Cherry Point, and Jacksonville Range Complexes)	
Level A	68
Level B	1,056,582
Beaked Whale Strandings	10
Navy Testing (concentrated in the VACAPES and Jacksonville Range Complexes)	
Level A	163
Level B	747,620
Level A, Unmanned Vehicles Demonstrations	~51 times per year (average from 253 over a 5-yr period)
G&G Activities (throughout AOI)	
Level A, seismic airgun, 180-dB criterion	Listed species (except West Indian manatee): • sperm whale – 45-310 individuals per year; • humpback whale – 2-12 individuals per year; • all other listed cetacean species – <9 individuals per year. Nonlisted species (except four pinnipeds – hooded seal, gray seal, harbor seal, and harp seal): • short-finned pilot whale – 840-4,631 individuals per year; • bottlenose dolphin – 2,091-11,748 individuals per year; • short-beaked common dolphin – 1,114-6,146 individuals per year; • Atlantic spotted dolphin – 989-5,848 individuals per year; • Risso's dolphin – 551-3,180 individuals per year; • Pantropical spotted dolphin – 146-876 individuals per year; • Long-finned pilot whale – 97-582 individuals per year; • Cuvier's beaked whale – 83-541 individuals per year; • Clymene dolphin – 67-406 individuals per year; • other cetacean species – <100 individuals per year.
Level A, seismic airgun, Southall et al. (2007) criterion	Listed species (except fin whale): • humpback whale – 0.7-5.9 individuals per year; • blue whale – 0.2-1.6 individuals per year; • Bryde's whale – 0.1-1.2 individuals per year; • all other listed cetacean species – <1 individual per year. Nonlisted species (species >50 individuals taken per year): • Atlantic spotted dolphin – 202-1,496 individuals per year; • striped dolphin – 158-1,020 individuals per year; • Risso's dolphin – 87-731 individuals per year; • pantropical spotted dolphin – 35-263 individuals per year; • short-beaked common dolphin – 23-225 individuals per year; • short-finned pilot whale – 12-151 individuals per year; • Clymene dolphin – 17-126 individuals per year; • long-finned pilot whale – 15-118 individuals per year.

Table 4-15. Comparison of Take Estimates from Acoustic Sources, Without Mitigation (continued).

Activity Source and Harassment Level	Incidental Take Estimates - Annual
Level B, seismic airgun, 160-dB criterion	Listed species (except West Indian manatee): • sperm whale – 4,361-30,356 individuals per year; • North Atlantic right whale – 60-224 individuals per year; • >100 individuals per year for all other listed species. Nonlisted species (except four pinnipeds – hooded seal, gray seal, harbor seal, and harp seal): • bottlenose dolphin – 1,151,442 individuals per year; • short-beaked common dolphin – 602,424 individuals per year; • Atlantic spotted dolphin – 573,121 individuals per year; • short-finned pilot whale – 453,897 individuals per year; • striped dolphin – 391,376 individuals per year; • Risso's dolphin – 311,717 individuals per year.
Level A, non-airgun HRG surveys, 180-dB criterion	Listed species (except West Indian manatee): • <1 individual per year for all listed species. Nonlisted species (except four pinnipeds – hooded seal, gray seal, harbor seal, and harp seal): • bottlenose dolphin – <1-6 individuals per year; • Atlantic spotted dolphin – 1-5 individuals per year; • short-beaked common dolphin – 1-4 individuals per year; • short-finned pilot whale, Risso's dolphin, striped dolphin – <1-2 individuals per year; • <1 individual per year for all nonlisted species.
Level A, non-airgun HRG surveys, Southall et al. (2007) criterion	Listed species (except fin whale): • all listed cetacean species – <1 individual per year. Nonlisted species (species >50 individuals taken per year): • Atlantic spotted dolphin – <1-7 individuals per year; • short-beaked common dolphin – 0-5 individuals per year; • Risso's dolphin – 0-2 individuals per year; • bottlenose dolphin – <1-2 individuals per year.
Level B, non-airgun HRG surveys, 160-dB criterion	Listed species (except West Indian manatee): • sperm whale – <1-12 individuals per year; • all other listed cetacean species – <1 individual per year. Nonlisted species (except four pinnipeds – hooded seal, gray seal, harbor seal, and harp seal): • bottlenose dolphin – 632 individuals per year; • Atlantic spotted dolphin – 490 individuals per year; • short-beaked common dolphin – 379 individuals per year; • short-finned pilot whale – 227 individuals per year; • Risso's dolphin – 170 individuals per year; • striped dolphin – 155 individuals per year; • other cetacean species – <50 individuals per year.